Claims

1. A method of determining of a physical feature of a medium, comprising:
- producing radiation with a light source (2);
- placing a probe on a sample (1) of said medium, said probe comprising a first optical fiber (5) having a first diameter, and at least a second optical fiber (6) having a second diameter;
- sending light coming from said light source, through said first optical fiber;
- collecting first backscattered radiation through said first optical fiber and second backscattered radiation through said second optical fiber;
- producing a first signal (I) based on said first backscattered radiation, and a second signal (J) based on said second backscattered radiation;
- determine a measured differential backscatter signal as a function of wavelength using said first and second signals (I, J),

characterized by
- calculating said physical feature by curve fitting said measured differential backscatter signal to a backscatter function, in which said backscatter function is a function of an average path-length (τ) travelled by detected scattered photons, said average path-length (τ) being independent from an absorption coefficient (μ_a) of said medium, and from a scattering coefficient (μ_s) of said medium.

2. Method according to claim 1, wherein said average path-length (τ) is also independent from a wavelength (λ) of said first and second backscattered radiation

3. Method according to claim 1, wherein said path-length (τ) is proportional to said first fiber diameter.

4. Method according to claim 1, wherein said backscatter function is given by:

$$R_{bs}=C1\cdot\mu_s\cdot\exp(-\tau\cdot\mu_a)$$
with $\tau = C2\cdot d_{fiber}$

where C1 and C2 are constants, μ_a = said absorption coefficient of said medium, μ_s = said scattering coefficient of said medium, and d_{fiber} = said first fiber diameter.

5. Method according to claim 4, wherein C2 is approximately 0.6.

6. Method according to any of claims 1-5, wherein said physical feature is a concentration of at least one substance in said medium.

7. A device for determining a physical feature of a medium, comprising:
- a light source (2) for producing radiation;
- a probe with at least a first and a second optical fiber (5, 6), said first optical fiber (5) having a first diameter and being arranged to deliver said radiation on a sample (1) of said medium and to collect first backscattered radiation from said sample (1), said second optical fiber (6) having a second diameter and being arranged to collect second backscattered radiation, wherein said second optical fiber (6) is positioned alongside said first optical fiber (5);
- a spectrometer (7) for producing a first signal (I) based on said first backscattered radiation, and for producing a second signal (J) based on said second backscattered radiation;
- a processor (9) arranged to determine a measured differential backscatter signal as a function of wavelength (λ) using said first and second signals (I, J),
characterized in that said processor is arranged to calculate said physical feature by curve fitting said measured differential backscatter signal to a backscatter function (R_{bs}), in which said backscatter function is a function of an average path-length (τ) travelled by detected scattered photons, said average path-length (τ) being independent from an absorption coefficient (μ_a) of said medium, and from a scattering coefficient (μ_s) of said medium.

8. Computer program product to be loaded by a computer, said computer program product, after being loaded, providing said computer with the capacity to:
- receive a first signal (I) indicative of a collected radiation received from a first fiber (5) and a second signal (J) indicative of a collected radiation received from a second fiber (6);

- determine a measured differential backscatter signal (R_{bs}) as a function of wavelength (λ) of said collected radiation using said first and second signals (I, J);

characterized by the capacity to

- calculate a physical feature by curve fitting said measured differential backscatter signal to a backscatter function, in which said backscatter function is a function of an average path-length (τ) travelled by detected scattered photons, said average path-length (τ) being independent from an absorption coefficient (μ_a) of said medium, and from a scattering coefficient (μ_s) of said medium.

9. Data carrier provided with a computer program product according to claim 8.

10. A method of determining a physical feature of a medium, comprising:

- producing radiation with a light source (2);
- placing a probe on a sample (1) of said medium, said probe comprising a first optical fiber (5) having a first diameter, and at least a second optical fiber (6) having a second diameter;
- sending light coming from said light source, through said first optical fiber;
- collecting first backscattered radiation through said first optical fiber and second backscattered radiation through said second optical fiber;
- producing a first signal (I) based on said first backscattered radiation, and a second signal (J) based on said second backscattered radiation;
- determine a measured differential backscatter signal as a function of wavelength using said first and second signals (I, J),

characterized by

- calculating said physical feature by curve fitting said measured differential backscatter signal to a backscatter function, in which said backscatter function is a function of a mean free path of photons.

11. Method according to claim 10, wherein said backscatter function (R_{bs}) is defined by:

$$R_{bs}(\lambda) = C_{app}' \cdot p(\lambda, 180) \cdot \mu_s(\lambda) \cdot \exp(-2 \cdot mfp(\lambda)) \cdot \sum_{i=1}^{n} \rho_i \cdot \mu_a^{spec,i}(\lambda))$$

where C_{app}' is an apparatus constant, $p(\lambda,180)$ is a phase function, $\mu_s(\lambda)$ is a scattering coefficient of said medium, λ is a wavelength of said first and second backscattered radiation, $mfp(\lambda)$ is said mean free path as a function of the wavelength, n is a number of substances in said medium, ρ_i is concentration of absorber i present in a detection volume of said sample (1), and $\mu_a^{spec,i}(\lambda)$ is an absorption coefficient of substance i as a function of the wavelength.

12. Method according to any of claims 10-11, wherein said physical feature is a concentration of at least one substance in said medium.

13. A device for determining a physical feature of a medium, comprising:
- a light source (2) for producing radiation;
- a probe with at least a first and a second optical fiber (5, 6), said first optical fiber (5) having a first diameter and being arranged to deliver said radiation on a sample (1) of said medium and to collect first backscattered radiation from said sample (1), said second optical fiber (6) having a second diameter and being arranged to collect second backscattered radiation, wherein said second optical fiber (6) is positioned alongside said first optical fiber (5);
- a spectrometer (7) for producing a first signal (I) based on said first backscattered radiation, and for producing a second signal (J) based on said second backscattered radiation;
- a processor (9) arranged to determine a measured differential backscatter signal as a function of wavelength (λ) using said first and second signals (I, J),
characterized in that said processor is arranged to calculate said physical feature by curve fitting said measured differential backscatter signal to a backscatter function (R_{bs}), wherein said backscatter function is a function of a mean free path of photons.

14. Computer program product to be loaded by a computer, said computer program product, after being loaded, providing said computer with the capacity to:
- receive a first signal (I) indicative for a collected radiation received from a first fiber (5) and a second signal (J) indicative for a collected radiation received from a second fiber (6);

- determine a measured differential backscatter signal (R_{bs}) as a function of wavelength (λ) of said collected radiation using said first and second signals (I, J);

<u>characterized by</u> the capacity to

- calculate a physical feature by curve fitting said measured differential backscatter signal to a backscatter function, wherein said backscatter function is a function of a mean free path of photons.

15. Data carrier provided with a computer program product according to claim 14.

16. Method according to any of the claim 1-6, 10-12 wherein said method comprises:

- simultaneously measuring backscatter radiation on different locations of said sample (1);
- determining a physical feature for said different locations;
- calculating a standard deviation of said physical feature.

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